

Applicant: Shi-Chang Wooh
For: DEFECT DETECTION SYSTEM AND METHOD

- 1 1. A defect detection system comprising:
 - 2 an excitation laser system for projecting a laser beam at the near surface of
 - 3 a sample to be tested for generating acoustic longitudinal, surface Rayleigh, and shear
 - 4 waves in the sample;
 - 5 a detection laser system spaced from said excitation laser to intercept shear
 - 6 waves reflected from the far surface of the sample at approximately the angle of
 - 7 maximum shear wave propagation; and
 - 8 a detection circuit for detecting the energy level of the reflected shear
 - 9 wave intercepted by said detection laser system representative of a flaw in the sample.
- 1 2. The defect detection system of claim 1 in which the excitation laser
- 2 system and detection laser system are on the same side of the sample.
- 1 3. The defect detection system of claim 1 including a movable support for
- 2 said excitation laser system and detection laser system for moving them along the sample.
- 1 4. The defect detection system of claim 1 in which said detection circuit
- 2 includes a shear wave sensing circuit for sensing the energy level of the acoustic wave
- 3 and the time of arrival of the reflected shear wave at the detection laser system.

1 5. The defect detection system of claim 4 in which said detection circuit
2 includes a first logic circuit for recognizing the presence of a potential flaw if the energy
3 level of the acoustic wave sensed by said shear wave sensing circuit is less than a
4 predetermined level.

1 6. The defect detection system of claim 5 in which said detection circuit
2 includes a surface Rayleigh wave sensing circuit for sensing the energy level of the
3 acoustic wave at the time of arrival of the surface Rayleigh wave at the detection laser
4 system.

1 7. The defect detection system of claim 6 in which said detection circuit
2 includes a second logic circuit for inhibiting recognition of a potential flaw if the energy
3 level of the acoustic wave sensed by said surface Rayleigh wave sensing circuit is less
4 than a predetermined level and confirming recognition if it is greater than the
5 predetermined level.

1 8. The defect detection system of claim 1 in which said detection circuit
2 includes a scanning device for sensing the variation in the energy level of the reflected
3 shear wave along the sample to create shadows of a flaw.

1 9. The defect detection system of claim 8 in which said detection circuit
2 includes a measuring circuit for measuring the length of each shadow cast by a flaw
3 blocking shear wave propagation and the distance between those shadows.

1 10. The defect detection system of claim 9 including a positioning circuit for
2 determining the location, size and orientation of a flaw.

1 11. The defect detection system of claim 1 in which the sample includes steel
2 and the angle of maximum shear wave propagation is approximately 40°.

1 13. The method of claim 12 in which the excitation and detection occurs on
2 the same side of the sample.

1 14. The method of claim 12 in which the excitation and detection points are
2 moved along the sample.

1 15. The method of claim 12 further including sensing the energy level of the
2 reflected shear wave and recognizing the presence of a potential flaw if the energy level is
3 below a predetermined level.

1 16. The method of claim 12 further including sensing the energy level of the
2 surface Rayleigh waves and inhibiting detection of a flaw if that level is below a
3 predetermined level and confirming recognition if it is greater than the predetermined
4 level.

1 17. The method of claim 12 further determining the variation in energy level
2 of the reflected shear wave along the sample to create shadows of the flaw.

1 18. The method of claim 17 further including measuring the length of each
2 shadow cast by the flaw.

1 19. The method of claim 18 further including determining the location, size
2 and orientation of a flaw from the size and separation of the shadows.

PCT/US2016/046360